

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of	)	
	)	Examiner: Ivars C. Cintins
<b>Mark Hernandez</b>	)	
	)	Art Unit: 1724
Serial No: 10/627,947	)	
	)	Attorney Docket: MJ-1
Filed: July 25, 2003	)	
	)	Date: December 1, 2006
For: REMOVING METALS FROM SOLUTION	)	
USING METAL BINDING COMPOUNDS AND	)	Confirmation #:2256
<u>SORBENTS THEREFOR</u>	)	

AMENDED BRIEF ON APPEAL

Mail Stop Appeal Brief - Patents  
 Commissioner of Patents  
 P. O. Box 1450  
 Alexandria, VA 22313

Dear Sir:

Applicants submit the following Amended Brief on Appeal pursuant to 37 C.F.R. § 41.37 (d) and in response to a Notification of Non-Compliant Appeal Brief dated November 3, 2006 to replace the original Brief on Appeal and in order to conform with the requirements of 37 C.F.R. 41.37(c), in order to address the Examiner's concerns. The original Brief on Appeal was filed in response to the Office Action (Final) dated (mailed) January 25, 2006. A Notice of Appeal was filed on June 20, 2006.

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## **I. REAL PARTY IN INTEREST**

The real party in interest is the Regents of the University of Colorado of Colorado, Boulder, Colorado.

## **II. RELATED APPEALS AND INTERFERENCES**

There are no related appeals or interferences which will affect or be affected by the outcome of this appeal.

## **III. STATUS OF THE CLAIMS**

The status of the claims in the subject application is as follows:

1- 22. (on appeal)

23. (canceled)

24-25. (on appeal)

26. (allowed)

27. (canceled)

28-35. (on appeal)

36-70. (canceled)

## **IV. STATUS OF AMENDMENTS**

In response to the Final Office Action issued on January 25, 2006, Appellants filed a Response After Final, however, this response did not contain any amendments.

## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

### **Independent Claim 1**

The invention of independent Claim 1 relates to a method, involving a solution having a specific acidic pH and containing metal cations, wherein an amphipathic, heterocyclic, metal-coordinating compound is added to the solution. (see Figures 2 and 7; Paragraphs 30, 101, 139 and 140). The amphipathic, heterocyclic, metal-coordinating compound is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific acidic pH (see Paragraph 101) and a sorbent, such that the addition at the specific acidic pH causes at least some of the metal-coordinating compound to bind with

some of the metal cations and at least some of the metal-coordinating compound sorbs to the sorbent, along with any metal cations bound therewith (see Figure 4; Paragraphs 30, 86, 108, 115, 117 and 140).

#### **Independent Claim 28**

The invention of independent Claim 28 recites a method for removing metal cations from a solution having a specific acidic pH. The method includes introducing an amphipathic, heterocyclic metal-coordinating compound (see Figures 2 and 7; Paragraphs 30, 101, 139 and 140) into the solution at the specific acidic pH that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH (see Paragraph 101), such that at least some of the metal cations bind with the binding compound. The solution is exposed to a sorbent at the specific acidic pH, so that at least some of the metal-coordinating compound sorbs to the sorbent along with any metal cations bound therewith (see Figure 11; Paragraph 137).

#### **Independent Claim 30**

The invention of Claim 30 recite the removal of metal cations (see paragraph 30) from a solution having a specific acidic pH by enclosing an amphipathic, heterocyclic metal-coordinating compound that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at said specific pH (see Paragraph 101) and a sorbent in a flow-through enclosure (see Paragraph 136; Figure 10). The solution is caused to flow through the enclosure such that at least some of the metal cations bind with the binding compound at the specific acidic pH and at least some of the metal-coordinating compound sorbs to the sorbent at said specific acidic pH, in the enclosure, along with any metal cations bound therewith (see Figure 13; paragraph 138 ).

#### **Independent Claim 33**

The invention of independent Claim 33 recites that (i) an amphipathic, heterocyclic, metal-coordinating compound and (ii) a sorbent, are added to a solution having a specific acidic pH (see Paragraph 101) and containing

metal cations (see paragraph 30) such that at least some of the metal-coordinating compound and at least some of the sorbent cooperate at the specific acidic pH to sequester at least some of the metal cations from the solution (see paragraph 131; Figure 13). The compound is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH (see Paragraph 101).

#### **Independent Claim 34**

The invention of independent Claim 34 recites a method for use in a solution, having a specific acidic pH that is sufficiently acidic to liberate metal cations into solution so as to contaminate the solution with the metal cations. The method includes binding at least some of the metal cations to an amphipathic, heterocyclic metal-coordinating compound, at the specific acidic pH, for subsequent use. (see paragraphs 33, 123, 149)

### **VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

The grounds of rejection to be reviewed on appeal are:

1. Claims 1-22, 24, 25 and 28-35 stand rejected under 35 U.S.C. 103 (a) as being unpatentable over a doctoral thesis entitled FATE AND TOXICITY OF AIRCRAFT DEICING FLUID ADDITIVES THROUGH ANAEROBIC DIGESTION by Cynthia Lee Gruden as directed by Dr. Mark Hernandez (hereinafter, Gruden) in view of another publication entitled METAL ADSORPTION BY ACTIVATED CARBON: EFFECT OF COMPLEXING LIGANDS, COMPETING ADSORBATES, IONIC STRENGTH, AND BACKGROUND ELECTROLYTE by Reed, et al. (hereinafter Reed).

2. Claim 34 additionally stands rejected under 35 U.S.C. § 103 (a) as being unpatentable over an EPA publication entitled INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: BENZOTRIAZOLES (hereinafter, the EPA publication).

### **VII. ARGUMENT**

#### **A. Grouping of Claims**

Applicant submits that the claims of Groups I, III and V do not stand or fall together. Applicant groups the claims on appeal, as follows:

Group I:	Claims 1-22, 24 and 25
Group II:	Claims 28 and 29
Group III:	Claim 30-32
Group IV:	Claim 33
Group V:	Claim 34
Group VI:	Claim 35

## B. Authorities

Obviousness under 35 U.S.C. § 103 requires establishing a prima facie case of obviousness. The Patent Office must demonstrate three criteria: (1) there must be some suggestion or motivation to one of ordinary skill in the art to modify a reference or to combine reference teachings; (2) there must be a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest each and every limitation in the claim under examination. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991). As stated in MPEP 2143 and 2143.01, a requirement for establishing a prima facie case of obviousness is that there must be some suggestion or motivation to combine the reference teachings. *In re Rouffet*, 149 F.3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1992). As quoted in MPEP 2143.01: "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." *In re Fritch*, 972 F.2d 1260, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). Moreover, the references must be taken in their entireties, including those portions which argue against obviousness. *Bausch & Lomb*, 230 U.S.P.Q. at 420. It is impermissible within the framework of 35 U.S.C. § 103 to pick and choose from a reference only so much of it as will support a conclusion of obviousness to the exclusion of other parts necessary to a full appreciation of what the reference fairly suggests to one skilled in the art. *Id.* at 419. The courts have long cautioned that consideration must be given "where the references diverge and teach away from the claimed invention." *Akzo N.V. v. International Trade Commission*, 1 U.S.P.Q.2d 1241, 1246 (Fed. Cir. 1986). Further, teaching away is the very antithesis of suggesting the claimed subject matter. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).

## C. Overview of Group I (Claims 1-22, 24 and 25).

Claims 1-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over a doctoral thesis entitled FATE AND TOXICITY OF AIRCRAFT DEICING FLUID ADDITIVES THROUGH ANAEROBIC DIGESTION by Cynthia Lee Gruden as directed by Dr. Mark Hernandez (hereinafter, Gruden) in view of another publication entitled METAL

**1) Distinctive Features of Group I (Claims 1-22, 24 and 25).**

Claim 1 relates to a method that operates using a solution having a specific acidic pH and containing metal cations. An amphipathic, heterocyclic, metal-coordinating compound is added to the solution. This compound is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific acidic pH. A sorbent is added to the solution, such that the addition at the specific acidic pH causes at least some of the metal-coordinating compound to bind with some of the metal cations and at least some of the metal-coordinating compound to sorb to the sorbent, along with any metal cations bound therewith.

**2) Specific Limitations of Group I (Claims 1-22, 24 and 25) not anticipated by the cited references.**

The Examiner mistakenly asserts that Gruden in view of Reed meets the combined limitations of Claim 1.

The rejection of Claim 1 relies on Gruden with respect to the following passage that relates to aircraft deicing fluid (ADF) waste, taken from page 123 of the reference and which is set forth immediately hereinafter for the Board's convenience:

Current novel digester configurations (USAB) have incorporated GAC as a support matrix to retain high biomass levels. Results from this research indicate that the addition of GAC to an anaerobic treatment system for ADF waste may diminish the toxic effects of MeBT and may eliminate MeBT from the effluent. This design may be fortuitous for other industrial waste streams because MeBT sorbs to GAC while simultaneously binding heavy metals; thus, adding MeBT to PACT or USAB may enable the treatment of waste streams with very high metals content that would otherwise be toxic.

Applicants believe that this passage is exclusively limited to the context of removing heavy metal in an anaerobic digester, as will be discussed below, sentence-by-sentence and referred to as the "Gruden passage."

The first sentence of the Gruden passage clearly states that the digester configurations that are under consideration have incorporated GAC as a support matrix for supporting a biomass. The purpose of the biomass, as part of a digester, is indeed to digest specific materials in a waste stream such as, for example, proteins. These materials may be referred to



hereinafter as "digestible materials." There is no other purpose for the biomass. Further, it is indisputable that the digester is inoperable for its intended purpose without the biomass. The GAC was introduced in the digester for purposes of retaining a high biomass level. In other words, the initial purpose for the GAC was to avoid the flushing of the biomass out of the digester by the waste stream, thereby "retaining" the biomass.

The second sentence of the Gruden passage refers to results that indicate that the addition of the GAC to an anaerobic treatment system for ADF waste further may diminish the toxic effects of the MeBT. Of course, this result is obtained since the MeBT sorbs to the GAC. It should be appreciated, however, that the "toxic effects" that are mentioned are the toxicity of the MeBT with respect to the biomass. In other words, without the GAC, the MeBT can kill the biomass. Hence, the GAC protects the biomass from the MeBT. Of course, the reasonable conclusion that can be drawn from this is that the waste stream must contain digestible materials or there would be no need for the biomass, in the first instance, and certainly no need to protect the biomass from MeBT.

In sum, to this point, the MeBT, which may enter the digester as pollution, may be toxic to the biomass of the digester, in and by itself. Gruden appreciates that the MeBT sorbs to the GAC in a way which protects the biomass from the toxicity of the MeBT. That is, by the MeBT sorbing to the GAC, the biomass is isolated and protected from the MeBT.

The third sentence of the Gruden passage then goes on to say that "This design may be fortuitous for other industrial waste streams because MeBT sorbs to GAC while simultaneously binding heavy metals..." Initially, it is pointed out that "This design" clearly refers to a digester including GAC for supporting a biomass. The question with respect to this initial portion of the third sentence is what is meant by the term "other industrial waste streams." The latter portion of the third sentence provides appropriate clarification as to what is meant by "other industrial waste streams." Specifically, following a semicolon, the third sentence states:

[T]hus, adding MeBT to PACT or USAB may enable the treatment of waste streams with very high metals content that would otherwise be toxic. [emphasis supplied]

Clearly, the subject matter has not been broadened by sentence three when the portion of the sentence, which follows the semicolon, is specifically addressed to adding MeBT to a PACT or USAB digester and serves as the

conclusion of the sentence. What is being discussed with respect to "other industrial waste streams" is a waste stream that is suited for processing by a digester. The "treatment" that is discussed is specifically treatment in a digester. The subject is the effect of MeBT on the function of a digester and, according to the passage, even this suggested extension is not a certainty and "may enable" such an extension of digester treatment. Again, this digester has a biomass that is supported by GAC. The concern with respect to the metal, which is the identical concern with respect to adding the MeBT, is the potential toxicity of the metal to the biomass. That is, this discussion is directed to protecting the biomass from the metal, in the identical spirit that the biomass was protected from the MeBT by the GAC support matrix. The waste stream, therefore, must include digestible materials that are the target for the digestive function of the biomass. Moreover, there is no reason to assume that the introductory portion of sentence three, which precedes the semicolon, would be so broad as to contemplate a waste stream that is not intended for processing in a digester, when the concluding portion of the sentence is specifically directed to digesters. It is Applicant's position that the "other industrial waste streams" are clearly intended to be processed by a digester.

In view of the foregoing, it is clear that the pre-semicolon portion of sentence three of the Gruden passage is being mischaracterized and taken in isolation from the rest of the passage as having an all-encompassing scope, in order to apply to any industrial waste stream, as is described in the second paragraph on page 4 of the Final Office Action. In this regard, it should be appreciated that the Examiner has carefully selected only a portion of one sentence in making out the rejection. It is well-settled that it is impermissible to pick and choose only so much of a reference is required to make out a rejection to the exclusion of what the reference teaches as a whole. Here, that selection is so specific as to be limited to a portion of a sentence. It is only in the context of such a broad, but unreasonable interpretation that the requirement of an acidic pH in Claim 1 can be met. With respect to the requirement for an acidic pH in Claim 1, the Examiner has admitted that Gruden discloses the claimed invention "with the exception of the pH." Clearly, the rejection fails when the passage, or even the sentence, is taken as a whole, for what it fairly teaches. It is clear that the relied on passage in Gruden is being mischaracterized and taken in isolation from the rest of the passage as having an all-encompassing scope, in order to apply to any industrial waste stream, even one that is acidic and which would render the Gruden digester inoperable for its intended purpose, since the acidity will kill the biomass that provides the very functionality of the digester. Further, no motivation is provided with respect to making this modification with respect to treating a metal cation containing solution, as suggested by the Examiner in the Advisory Action dated May 23, 2006, since the relied on passage says nothing about metal cations nor the acidic environment that would be required to produce them. When viewed in a reasonable light, Gruden clearly requires a waste stream for treatment by an anaerobic

digester and teaches directly away from the claimed invention, which is intended to treat an acidic waste stream. Thus, it is respectfully submitted that a prima facie case of obviousness has not been made out for at least these reasons. Accordingly, for at least these reasons, allowance of Claims 1, 28, 30, 33 and 34 and their dependents is respectfully requested.

With respect to any reliance on the Reed reference for purposes of curing the deficiency of Gruden, in failing to teach, disclose or reasonably suggest an acidic pH, it is respectfully submitted that Reed is clearly deficient at least for the reasons set forth in Applicants' response of August 24, 2006. In particular, Reed is specifically limited to the mechanism of electrostatic immobilization and even disclaims any understanding of other types of mechanisms. As discussed in Applicants prior response, Reed is directed to removal of metal contamination, specifically testing cadmium and nickel over a range having a lower limit of pH 3. Reed includes a particular focus on electrostatic force (i.e., electrostatic immobilization). Further, Reed is considered to fall within the class of electrostatic immobilization prior art techniques. Applicants' technique does not use this mechanism as set forth, for example, by Claim 1.

Reed discusses surface charge characteristics of activated carbons in water and presents an equation that includes an electrostatic component on page 1987. This mechanism is discussed on the same page, fourth paragraph. Electrostatic force is brought into play in the Scenario 1 discussion on page 1988 of Reed which discusses the electric double layer of activated carbon, that is considered by Applicants as an electrostatic characteristic. Page 1989 includes an extensive discussion of electrostatic force with respect to both Reed's Scenario 2 and Scenario 3. Applicants consider that there are other points in the Reed reference that clearly limit its application to the use of electrostatic immobilization and disclaims an understanding of other mechanisms, at least some of which are discussed in Applicants response of August 24, 2006.

Still considering the rejection of Claim 1 under section 103, it is well-settled that a rejection under section 103 must be supported by an objective teaching in the art of record to make the proposed modification or modifications. As described above, Gruden describes the removal of methylbenzotriazole from aircraft deicing fluid. Further, there is no discussion, or experimental observation, in Gruden with respect to an acidic environment nor is there a teaching in Gruden with respect to the presence of any metal contamination in this run-off. Reed, on the other hand, teaches removal of metal contamination in an acidic environment using electrostatic charge with EDTA and a unique carbon that maintains a positive charge at negative pH. Thus, there are major mechanistic differences in Gruden and a very major

difference in Reed, as distinguished from the present invention, as recited in Claim 1. For example, the Gruden environment is defined by anaerobic microbiological activity and is expressly not acidic for this reason, and there is absolutely no suggestion in Gruden of an acidic environment. With this in mind, it is impossible to modify the Gruden reference to process an acidic waste stream, since the digester will be completely inoperable for its intended purpose. As another example, the use of EDTA by Reed to remove metal contaminants is an entirely different and clearly distinguishable approach as compared to the approach taken by Applicants, namely the use of an amphipathic, heterocyclic metal coordinating compound as recited by amended Claim 1, discussed in the specification and in the present Brief on Appeal. Moreover, the activated carbon must include the correct forced charge at low pH, in order to use the Reed technique. Applicants respectfully submit that there would be no motivation to make the proposed modifications of Gruden in view of Reed, since Gruden is not dealing with an acidic environment, but rather contains an unsupported suggestion in relation to anaerobic digesters. The two references are completely disparate in these respects. Modification of an anaerobic digester to process an acidic waste stream will result in a device that is inoperable for its intended purpose. Further, amphipathic, heterocyclic compounds do not partition on the basis of electrostatic attraction, but maintain charge neutrality in acidic environments, as described in paragraph 85 of the specification. Clearly, Applicants are not claiming electrostatic immobilization and, in fact, are claiming something that is quite the opposite. Thus, Reed is viewed as teaching away from the limitations of Claim 1. As set forth above, teaching away is regarded as the very antithesis of suggesting the claimed combination. Accordingly, for these reasons, standing on their own, it is believed that Claim 1 is allowable over the art of record. Hence, for at least the foregoing reasons, Applicants respectfully request that the Board overturn the rejection of Claim 1.

It is assumed that the dependent claims carry with them the arguments made in favor of their base claims and any intervening claims. Claims 2-22, 24 and 25 depend either directly or indirectly from Claim 1 and, therefore, include all of the features recited by Claim 1. It is therefore respectfully submitted that the art of record fails to anticipate these dependent claims at least for the same reasons set forth above in support of the patentability of Claim 1.

For example, Claim 3 recites that the metal-coordinating compound includes a binding portion containing a plurality of heteroatoms and a hydrophobic portion for hydrophobically sorbing to the sorbent. It is noted that this claim is considered to clearly exclude the use of immobilization via electrostatic force. For at least this reason, it is respectfully requested that the Board overturn the rejection of Claim 3.

As another example, Claim 5 recites that the specific pH is in a range from approximately pH 2 to pH 6 and the metal-coordinating compound is Benzotriazole, Benzothiazole or Methylbenzotriazole. It is of interest to note that the Reed reference shows no data below pH 3. In this regard, it is suspected that the electrostatic immobilization technique taught by Reed is inoperable at such depressed pH levels at least for the reason that the selected H type carbon and metal-chelating EDTA will experience a markedly lesser attraction as EDTA interacts with protons and the positively charged state of the activated carbon increases with continued pH depression. Hence, for at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 3.

As a further example, Claim 7 recites an extremely acidic environment in which the specific pH is less than approximately 2. Again, Reed shows no data below pH 3. Claim 8 depends from Claim 7 and recites that the metal-coordinating compound is selected as at least one of carboxybenzotriazole, any fatty acid conjugated benzotriazole derivative, butylbenzotriazole, other aliphatic conjugated benzotriazole and benzothiazole. Claim 9 depends from Claim 7 and requires that the sorbent is an acidic activated carbon. Claim 10, likewise depends from Claim 7 and requires that the sorbent is an L type activated carbon. Reed specifically uses an H type activated carbon. Clearly, the art of record is devoid of any teaching with respect to operation below pH 2. Hence, for at least these reasons, it is respectfully requested that the Board overturn the rejections of Claims 7-10.

Claim 11 depends from Claim 9 and recites that the metal-coordinating compound is at least one of benzotriazole and benzothiazole. Claim 12 depends from Claim 11 and further requires that the sorbent is an acidic activated carbon. Claim 13 also depends from Claim 11 and further requires that the sorbent is an L type activated carbon, as opposed to the use of an H type carbon in Reed. Again, the art of record is devoid of any teaching with respect to operation below pH 2 and particularly the use of these materials, as claimed, including L type activated carbon. Hence, for at least these reasons, it is respectfully requested that the Board overturn the rejections of Claims 11-13.

Claim 15 recites equilibrating the sorbent and the metal-coordinating compound prior to enclosing. Applicants are unable to find any reasonably related teaching in the art of record. In the context of the rejections, the Examiner merely asserts that the use of an enclosure is obvious. While these limitations were raised in Applicants' response of August 24, 2005, Applicants find no specific rationale made by the Examiner in support of the rejection. Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been made out. For at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 15.

Claim 16 recites removing from the solution the metal-coordinating compound sorbed to the sorbent and the metal cations bound with the sorbed metal-coordinating compound. Applicants are unable to find any reasonable teaching with respect to these limitations in the art of record. While these limitations were raised in Applicants' response of August 24, 2005, Applicants find no specific rationale made by the Examiner in support of the rejection. Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been made out. For at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 16.

Claim 18 requires that adding includes forming a combination of the metal-coordinating compound sorbed to the sorbent and, thereafter, introducing the combination into the solution. Applicants respectfully submit that the art of record is devoid of this feature in any reasonable combination. While these limitations were raised in Applicants' response of August 24, 2005, Applicants find no specific rationale made by the Examiner in support of the rejection. Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been made out. For at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 18.

Claim 19 requires that adding includes separately introducing each of the metal-coordinating compound and the sorbent to the solution. Claim 20 further requires that the metal-coordinating compound is introduced before the sorbent is introduced. Applicants respectfully submit that the art of record is devoid of any reasonable suggestion of these features in any reasonable combination. Further, Applicants are unable to find any discussion of these features in the rejections of the claims. Hence, for at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 19.

#### **D. Overview of Group II (Claims 28 and 29).**

##### **1) Distinctive Features of Group II.**

Claim 28 recites a method for removing metal cations from a solution having a specific acidic pH. The method includes introducing an amphipathic, heterocyclic metal-coordinating compound into the solution at the specific acidic pH that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH, such that at least some of the metal cations bind with the binding compound; and exposing the solution to a sorbent at said specific acidic pH, so

that at least some of the metal-coordinating compound sorbs to the sorbent along with any metal cations bound therewith.

**2) Specific Limitations of Group II (Claims 28 and 29) not anticipated by the cited references.**

Claim 28 is an independent method claim embracing certain features that have addressed above, with respect to Claim 1, and which are believed to patentably distinguish over the art of record. To the extent that the limitations embraced by Claim 28 encompass the limitations of Claim 1, as discussed above, the related arguments above in favor of the patentability of Claim 1 over the art of record are considered to be equally applicable with respect to the patentability of the limitations that are encompassed by Claim 28. For example, an amphipathic, heterocyclic metal-coordinating compound is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH.

It is assumed that the dependent claims carry with them the arguments made in favor of base claims and any intervening claims. Claim 29 depends directly from Claim 28 and, therefore, includes all of the features recited by Claim 28. It is therefore respectfully submitted that the art of record fails to anticipate this dependent claim at least for the same reasons set forth above in support of the patentability of Claim 28.

**E. Overview of Group III (Claims 30-32).**

**1) Distinctive Features of Group III.**

Claim 30 recites a method for removing metal cations from a solution having a specific acidic pH. The method includes enclosing an amphipathic, heterocyclic metal-coordinating compound that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH and a sorbent in a flow-through enclosure. The solution is caused to flow through the enclosure such that at least some of the metal cations bind with the binding compound at the specific acidic pH and at least some of the metal-coordinating compound sorbs to the sorbent at the specific acidic pH, in the enclosure, along with any metal cations bound therewith.

**2) Specific Limitations of Group III not anticipated by the cited references.**

Claim 30 is an independent method claim embracing certain features that have addressed above, with respect to Claim 1, and which are believed to patentably distinguish over the art of record. To the extent that the limitations embraced by Claim 30 encompass the limitations of Claim 1, as discussed above, the related arguments above in favor of the patentability of Claim 1 over the art of record, are considered to be equally applicable with respect to the patentability of the limitations that are encompassed by Claim 30. For example, an amphipathic, heterocyclic metal-

coordinating compound is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH so that at least some of the metal cations bind with the binding compound at the specific acidic pH and at least some of the metal-coordinating compound sorbs to the sorbent at the specific acidic pH. Moreover, Claim 30 provides additional limitations that are considered to further distinguish over the art of record. For example, the amphipathic, heterocyclic metal-coordinating compound and sorbent are enclosed in a flow-through enclosure.

It is assumed that the dependent claims carry with them the arguments made in favor of base claims and any intervening claims. Claims 31 and 32 depend directly from Claim 30 and, therefore, includes all of the features recited by Claim 30. It is therefore respectfully submitted that the art of record fails to anticipate these dependent claims at least for the same reasons set forth above in support of the patentability of Claim 30.

For example, Claim 31 recites sorbing the metal-coordinating compound to the sorbent before enclosing. While these limitations were raised in Applicants' response of August 24, 2005. Applicants find no specific rationale made by the Examiner in support of the rejection. Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been made out. For at least this reason, it is respectfully requested that the Board overturn the rejection of Claim 30.

As another example, Claim 32 recites equilibrating the metal-coordinating compound with the sorbent before enclosing the materials. While these limitations were raised in Applicants' response of August 24, 2005. Applicants find no specific rationale made by the Examiner in support of the rejection. Accordingly, it is respectfully submitted that a prima facie case of obviousness has not been made out. For at least this reason, it is respectfully requested that the Board overturn the rejection of Claim 30.

## **F. Overview of Group IV (Claim 33)**

### **1) Distinctive Features of Group IV.**

Claim 33 recites that (i) an amphipathic, heterocyclic, metal-coordinating compound and (ii) a sorbent, are added to a solution having a specific acidic pH and containing metal cations such that at least some of the metal-coordinating compound and at least some of the sorbent cooperate at the specific acidic pH to sequester at least some of the metal cations from the solution. The compound is selected based, at least in part, on a charge distribution which



maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at the specific pH.

**2) Specific Limitations of Group IV not anticipated by the cited references.**

Claim 33 is an independent method claim embracing certain features that have addressed above, with respect to Claim 1, and which are believed to patentably distinguish over the art of record. At least to the extent that Claim 33 reflects the limitations of Claim 1, as discussed above, the arguments made with respect to the patentability of Claim 1 over the art of record are considered by Applicants as equally applicable with respect to the patentability of Claim 33. Accordingly for at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 33.

**G. Overview of Group V (Claim 34)**

Claim 34 stands rejected under 35 U.S.C. § 103 (a) as being unpatentable over an EPA publication entitled INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: BENZOTRIAZOLES (hereinafter, the EPA publication). Claim 34 is also rejected under 35 U.S.C. § 103 (a) as being unpatentable over Gruden in view of Reed.

**1) Distinctive Features of Group V.**

Independent Claim 34 recites a method, used in a solution, having a specific acidic pH that is sufficiently acidic to liberate metal cations into solution so as to contaminate the solution with the metal cations. The method includes binding at least some of the metal cations to an amphipathic, heterocyclic metal-coordinating compound, at the specific acidic pH, for subsequent use.

**2) Specific Limitations of Group V not anticipated by the cited references.**

With respect to the rejection of Claim 34 over the EPA publication, the Examiner has taken the position that this reference discloses the claimed invention with the exception of the recited pH. And that since the reference fails to disclose any criticality for the pH of the wastewater, one would be motivated to use the disclosed method in a slightly acidic pH. Applicants respectfully disagree. Initially, it is noted that the reference teaches the use of a very large amount

of benzene solvent (one volume per two volumes of wastewater) in combination with benzotriazole. Thus, it is submitted that the reference is teaching a completely different method. Further, the removal mechanism is not described and there is no reason to assume that the presence of the benzene is not critical to the process outcome. Moreover, the reference admits that the remaining benzene is problematic and offers no remedy. With regard to the use of benzene in the EPA publication, the Examiner has taken the position that Claim 34 does not exclude the use of benzene in combination with the metal coordinating compound and, therefore the requirement in the EPA publication to use benzene is deemed not to be relevant. Applicants respectfully disagree with this position and respectfully submit that this is improper under well-settled standards in making out a rejection under § 103. Applicants regard the use of benzene in the EPA reference as teaching away from the limitations at hand. The teachings of a reference, as a whole cannot simply be ignored, while picking and choosing only so much of the reference is necessary in making out the rejection. Here, Applicants respectfully submit that what is missing from the EPA publication, and the art of record, is an objective teaching to eliminate the requirement for using benzene. Thus, there is no motivation to modify the reference in the suggested manner. Accordingly, for these reasons, standing on their own, it is respectfully submitted that a prima facie case of obviousness has not been made out with respect to the rejection of Claim 34 over the EPA publication.

Now considering the § 103 rejection of Claim 34 over Gruden in view of Reed, this claim is an independent method claim embracing certain features that have addressed above, with respect to Claim 1, and which are believed to patentably distinguish over the art of record. At least to the extent that Claim 34 reflects the limitations of Claim 1, as discussed above, the arguments made with respect to the patentability of Claim 1 over the art of record are considered by Applicants as equally applicable with respect to the patentability of Claim 34. Accordingly for at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 34.

#### **H. Overview of Group VI (Claim 35).**

Claim 35 was rejected under 35 U.S.C. 103 as being obvious over Gruden in view of Reed.

##### **1) Distinctive Features of Group VI.**

Claim 35 recites sorbing at least some of the metal-coordinating compound and metal cations bound thereto using an activated carbon at the specific acidic pH.

##### **2) Specific Limitations of Group VI not anticipated by the cited references.**

It is assumed that the dependent claims carry with them the arguments made in favor of base claims and any intervening claims. Claim 35 depends directly from Claim 34 and, therefore, includes all of the features recited by Claim 34. It is therefore respectfully submitted that Claim 34 is patentable over the art of record for at least for the same reasons set forth above in support of the patentability of Claim 34. Accordingly for at least these reasons, it is respectfully requested that the Board overturn the rejection of Claim 35.

Based on the foregoing, Applicant respectfully requests that the Board overturn the Examiner's rejections of all pending claims, that have not yet been allowed, and hold that all of the claims of the present Application are allowable.

Dated: December 1, 2006

Respectfully submitted,  
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## VIII. CLAIMS APPENDIX

The claims involved in this Appeal are as follows:

1. A method, comprising:

in a solution having a specific acidic pH and containing metal cations, adding (i) an amphipathic, heterocyclic, metal-coordinating compound that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at said specific acidic pH and (ii) a sorbent, such that the addition at the specific acidic pH causes at least some of the metal-coordinating compound to bind with some of the metal cations and at least some of the metal-coordinating compound to sorb to the sorbent, along with any metal cations bound therewith.

2. The method of claim 1 wherein said sorbent includes activated carbon.

3. The method of claim 1 wherein said metal-coordinating compound includes a binding portion containing a plurality of heteroatoms and a hydrophobic portion for hydrophobically sorbing to the sorbent.

4. The method of claim 1 wherein the metal-coordinating compound is selected from the group consisting of a benzotriazole and a benzothiazole.

5. The method of claim 1 wherein said specific pH is in a range from approximately pH 2 to pH 6 and said metal-coordinating compound is benzotriazole, benzothiazole or methylbenzotriazole.

6. The method of claim 5 wherein said sorbent is an H type activated carbon.

7. The method of claim 1 wherein said specific pH is less than approximately 2.

8. The method of claim 7 wherein said metal-coordinating compound is selected as at least one member of the group consisting of carboxybenzotriazole, any fatty acid conjugated benzotriazole derivative, butylbenzotriazole, other aliphatic conjugated benzotriazole and benzothiazole.

9. The method of claim 7 wherein said sorbent is an acidic activated carbon.

10. The method of claim 7 wherein said sorbent is an L type activated carbon.

11. The method of claim 9 wherein said metal-coordinating compound is at least one of benzotriazole and benzothiazole.

12. The method of claim 11 wherein said sorbent is an acidic activated carbon.

13. The method of claim 11 wherein said sorbent is an L type activated carbon.

14. The method of claim 1 including enclosing the sorbent and the metal-coordinating compound in a liquid permeable enclosure through which said acidic solution passes.

15. The method of claim 14 including equilibrating the sorbent and the metal-coordinating compound prior to said enclosing.

16. The method of claim 1 including removing from the solution the metal-coordinating compound sorbed to the sorbent and the metal cations bound with the sorbed metal-coordinating compound.

17. The method of claim 1 wherein the metal cations bind the metal-coordinating compound by each metal ion coordinating with a plurality of heteroatoms of the metal-coordinating compound.

18. The method of claim 1 wherein adding includes forming a combination of the metal-coordinating compound sorbed to the sorbent and, thereafter, introducing the combination into said solution.

19. The method of claim 1 wherein adding includes separately introducing each of the metal-coordinating compound and the sorbent to said solution.

20. The method of claim 19 wherein said metal-coordinating compound is introduced before said sorbent is introduced.

21. The method of claim 1 wherein said metal-coordinating compound includes a ring selected from the group consisting of a triazole ring and a thiazole ring and the metal cations bind with said ring.

22. The method of claim 1 wherein said solution is aqueous and adding includes selecting a compound from the group consisting of a benzotriazole and a benzothiazole as said metal-coordinating compound.

23. (canceled)

24. The method of claim 1 wherein the metal cations include at least one of an arsenic ion, a cadmium ion, a cobalt ion, a copper ion, a gold ion, a iron ion, a lead ion, a mercury ion, a nickel ion, a selenium ion, a silver ion, and a zinc ion and wherein the method includes selecting as the sorbent an activated carbon.

25. The method of claim 1 wherein (1) said metal cations which are bound with said metal-coordinating compound, and (2) said metal-coordinating compound sorbed to said sorbent form a complexation, said method further comprising: removing the metal cations from the complexation to recover a base metal of the metal cations.

26. A method, comprising:

in a solution having a specific acidic pH and containing metal cations, adding (i) an amphipathic, heterocyclic, metal-coordinating compound and (ii) a sorbent and providing said metal-coordinating compound and said sorbent in a dissolvable tablet form, such that the addition at the specific acidic pH causes at least some of the metal-coordinating

compound to bind with some of the metal cations and at least some of the metal-coordinating compound to sorb to the sorbent, along with any metal cations bound therewith.

27. (canceled)

28. A method for removing metal cations from a solution having a specific acidic pH, said method comprising: introducing an amphipathic, heterocyclic metal-coordinating compound into the solution at the specific acidic pH that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at said specific pH, such that at least some of the metal cations bind with the binding compound; and

exposing the solution to a sorbent at said specific acidic pH, so that at least some of the metal-coordinating compound sorbs to the sorbent along with any metal cations bound therewith.

29. The method of claim 28 wherein exposing includes (i) enclosing the sorbent in a flow-through enclosure and (ii) causing the solution, including the metal-coordinating compound, to flow through the sorbent in said enclosure for sorbing the metal-coordinating compound and metal cations bound therewith.

30. A method for removing metal cations from a solution having a specific acidic pH, said method comprising: enclosing an amphipathic, heterocyclic metal-coordinating compound that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at said specific pH and a sorbent in a flow-through enclosure; and

causing said solution to flow through the enclosure such that at least some of the metal cations bind with the binding compound at the specific acidic pH and at least some of the metal-coordinating compound sorbs to the sorbent at said specific acidic pH, in said enclosure, along with any metal cations bound therewith.

31. The method of claim 30 including sorbing the metal-coordinating compound to the sorbent before said enclosing.

32. The method of claim 30 including equilibrating the metal-coordinating compound with the sorbent before said enclosing.

33. A method, comprising:

in a solution having a specific acidic pH compound that is selected based, at least in part, on a charge distribution which maintains, at least approximately, a charge neutrality of the amphipathic, heterocyclic, metal-coordinating compound at said specific pH and containing metal cations, adding (i) an amphipathic, heterocyclic, metal-coordinating compound and (ii) a sorbent, such that at least some of the metal-coordinating compound and at least some of the sorbent cooperate at the specific acidic pH to sequester at least some of the metal cations from the solution.

34. In a solution, having a specific acidic pH that is sufficiently acidic to liberate metal cations into solution so as to contaminate the solution with the metal cations, a method comprising:  
binding at least some of the metal cations to an amphipathic, heterocyclic metal-coordinating compound, at said specific acidic pH, for subsequent use.

35. The method of Claim 34 including sorbing at least some of the metal-coordinating compound and metal cations bound thereto using an activated carbon at the specific acidic pH.

#### **IX. EVIDENCE APPENDIX**

No evidence is being submitted.

#### **X. RELATED PROCEEDINGS APPENDIX**

There are no related proceedings.